Therefore I Claim

1. A method of direct metal fabrication to form a metal part which has a relative density of at least 96%, said method comprising:

   a) providing a powder blend which comprises a powdered parent metal alloy, a powdered lower-melting-temperature alloy that comprises greater than 10% of the total weight of the powdered blend, and an organic polymer component that comprise less than 3% by weight of the total weight of the powdered blend;

   b) performing a layer-build powder processing operation to fabricate a green body by laying down successive layers of the powder blend and sintering the layers in accordance with a predetermined pattern;

   c) positioning the green part in a chamber of the furnace and raising the temperature in the chamber to reduce the organic polymer and then accomplish a supersolidus liquid phase sintering operation to form the metal part that by sinter densification obtains a relative density of at least 96%.

2. The method of claim 1, wherein said polymer comprises two polymers.

3. The method as recited in claim 2, wherein said two polymers comprise a thermoplastic polymer and a thermosetting polymer.

4. The method as recited in claim 3, wherein said layer-build powder processing operation comprises a selective laser sintering (SLS) operation.

5. The method as recited in claim 1, wherein said layer build powder processing operation comprises a selective laser sintering (SLS) operation.

6. The method as recited in claim 4, wherein the particle size of the parent metal alloy and a lower-melting-temperature alloy are about of a particle size such that the particles pass a 270 mesh screen.

7. The method as recited in claim 4, wherein particles of the parent metal alloy and a lower-melting-temperature alloy are about of a particle size such that the particles pass a 140 mesh screen.

8. The method as recited in claim 4, wherein particles of the parent metal alloy and a lower-melting-temperature alloy are about of a particle size that the particles pass a 325 mesh screen.

9. The method as recited in claim 1, wherein particles of the parent metal alloy and a lower-melting-temperature alloy are

about of a particle size that the particles pass a 400 mesh screen.

10. The method as recited in claim 1, wherein the supersolidus liquid phase sintering operation occurs predominately in a temperature range between greater than about 2248°F and less than about 2267°F.

11. The method as recited in claim 4, wherein the supersolidus liquid phase sintering operation occurs predominately in a temperature range between about 2252°F to about 2260°F.

12. The method as recited in claim 4, wherein said lower-melting-temperature alloy contains a eutectic ingredient selected from boron, manganese, yttrium, niobium, silicon, cobalt, and combinations of these.

13. The method as recited in claim 4, wherein said lower-melting-temperature alloy contains a eutectic ingredient which substantially comprises boron.

14. The method as recited in claim 4, wherein said parent metal alloy comprises predominately a primary ingredient selected from nickel, iron, cobalt, copper, tungsten, molybdenum, rhenium, titanium, aluminum, and mixtures thereof.

15. The method as recited in claim 4, wherein the parent metal alloy comprises primarily nickel.

16. The method as recited in claim 4, wherein said parent metal alloy comprises primarily a 230 alloy.

17. The method as recited in claim 4, wherein the powdered organic polymer comprises no greater than about 2% by weight of the total weight of the powdered blend.

18. The method as recited in claim 4, wherein the powdered organic polymer comprises no greater than about 1% by weight of the total weight of the powdered blend.

19. The method as recited in claim 4, wherein the powdered organic polymer comprises no greater than about 1/200 of weight of the total weight of the powdered blend.

20. The method as recited in claim 4, wherein the green body which is made by the selective laser sintering operation has a relative density of at least 58%.

21. The method as recited in claim 4, wherein:

a) a substantial portion of the particles of the parent metal alloy and a lower-melting-temperature alloy are of a particle size that the particles pass a 140 mesh screen;

b) the supersolidus liquid phase sintering operation occurs predominately in a temperature range greater than between 2248°F and less than 2267°F;

c) said lower-melting-temperature alloy contains a eutectic ingredient selected from boron, manganese, yttrium, niobium, silicon, cobalt, and combinations of these.

22. The method as recited in claim 19, wherein said parent metal alloy comprises predominately a primary ingredient selected from nickel, iron, cobalt, copper, tungsten, molybdenum, rhenium, titanium, aluminum, and mixtures thereof.

23. The method as recited in claim 4, wherein:

a) particles of the parent metal alloy and a lower-melting-temperature alloy are of a particle size that the particles pass a 270 mesh screen;

b) the supersolidus liquid phase sintering operation occurs predominately in a temperature range between about 2252°F to about 2260°F;

c) the powdered organic polymer comprises no greater than about 1% by weight of the total weight of the powdered blend.

24. The method as recited in claim 23, wherein the parent metal alloy comprises primarily nickel.

25. The method as recited in claim 4, wherein said parent metal alloy comprises primarily a 230 alloy.

26. The method as recited in claim 4, wherein the ratio of the amount of powdered low-melting-temperature alloy to the amount of the powdered organic polymer is by weight is at least as great than 5:1.

27. The method as recited in claim 4, wherein the ratio of the amount of powdered low-melting-temperature alloy to the amount of the powdered organic polymer is by weight at least as great as 10:1

28. The method as recited in claim 4, wherein the ratio of the amount of powdered low-melting-temperature alloy to the amount of the powdered organic polymer is by weight at least as great as 30:1.

29. The method as recited in claim 4, wherein there is in the chamber of the furnace at least during the supersolidus liquid phase sintering a gaseous atmosphere of hydrogen and an inert gas in a ratio of no greater than about 1 to 19, measured by volume at the same temperature and pressure.

30. The method as recited in claim 29, wherein said ratio is about 1 to 19.

31. The method as recited in claim 29, wherein said inert gas comprises argon.

32. A metal part made according to the method of claim 1.

33. A powdered composition adapted to be used in direct metal fabrication to form a metal part which has a relative density of at least 96%, wherein the metal part is formed by:

a) performing a laser-build powder processing operation to fabricate a green body by laying down successive layers of the powdered composition and laser sintering the layers in accordance with a predetermined pattern;

b) positioning the green part in a chamber of the furnace and raising the temperature in the chamber to reduce the organic polymer and then accomplish a supersolidus liquid phase sintering operation to form the metal part that by sinter densification obtains a relative density of at least 96%,

said powdered composition comprising a powder blend which comprises a powdered parent metal alloy, a powdered lower-melting-temperature alloy that comprises greater than 10% of the total weight of the powdered blend, and a powdered organic polymer component that comprises less than 3% by weight of the total weight of the powdered blend.

34. A method as recited in claim 33, wherein said polymer component comprises a thermoplastic polymer and a thermosetting polymer.